In 1878 Dunér turned his attention to stellar spectra, and with only a 10-inch refractor at his disposal, courageously entered upon a systematic survey of the red stars. His classical memoir, "Sur les étoiles à spectres de la troisième classe," 1884, gives details of his eminently successful observations of the spectra of 352 stars. Further observations were made with the Upsala 36 cm. refractor in 1893. The interest of such observations is now largely discounted by the entry of the giant telescopes and spectrographs of America into this field of research, but Dunér rightly considered that comparative observations of a large number of stars by a single observer might have a special value.

Another important investigation by Duner was that on the sun's rotation, carried out at Lund, and later at Upsala, with a powerful grating spectroscope which he designed for this purpose. His memoir, "Recherches sur la Rotation du Soleil" (1891), is a model report on a scientific investigation, and a lasting tribute to the skill of its author. The observations were extended to solar latitude 70°, and showed that the polar retardation indicated by spots was continued far beyond the sun-spot zones.

Dunér was an inspiring teacher, and his amiability and self-sacrificing devotion to their interests gained for him the affection and gratitude of his pupils and fellow-workers. His scientific achievements brought him many distinctions, among which may be mentioned the award of the Rumford medal by the Royal Society in 1892, and election as an Associate of the Royal Astronomical Society in 1889.

NOTES.

INQUIRIES which reach us from time to time suggest that many people would find it a convenience to be able to examine books received from publishers abroad and reviewed in NATURE. These volumes are usually not readily accessible, and often the only copies existing in this country are the few sent to scientific journals for review. We have therefore made arrangements to retain at NATURE office, St. Martin's Street, W.C., for a period of six months after the issues in which the reviews have appeared, all volumes published in countries outside the United Kingdom. Every volume from abroad reviewed in our columns will thus be on view freely to anyone who cares to call to see it. This arrangement will begin with our first issue in the New Year, and we believe that many men of science will welcome the opportunity which it will afford them of inspecting American and foreign books of which reviews have been printed in NATURE.

AFTER a long period of service in that capacity, Mr. W. L. Distant is resigning the editorship of the *Zoologist.*

THE Rome correspondent of the *Times* reports that among the Italian Senators who are to be nominated on New Year's Day is Signor Marconi.

THE death is announced at Los Angeles, in his seventy-sixth year, of Dr. John Muir, member of the Washington Academy of Sciences, and distinguished as an explorer and naturalist, as well as by his work for many years in the cause of forest preservation.

IT is announced in *Science* that in the will of the late Miss Dessie Greer, the American Museum of Natural History is designated as the ultimate beneficiary of a fund of 18,000*l.* By the will of the late Mr. W. Endicott, of Boston, a bequest of 5000*l.* for cancer research is made to Harvard University.

THE death is announced, at sixty-four years of age, of Sir Robert Simon, professor of therapeutics in the University of Birmingham since 1910, and author of a book on "Disease of Brass Workers" and other works; also of Mr. D. Balfour, member of the Institution of Civil Engineers, and a fellow of the Geological and the Royal Meteorological Societies.

WE regret to announce the death, in his seventy-second year, of Dr. Leon Lereboullet, president of the French Medical Association, and associate member of the Academy of Medicine. An obituary notice in the *British Medical Journal* points out that he collaborated with Dechambre on the *Gazette Hebdomadaire de Chirurgie,* and was editor of the "Dictionnaire Encyclopédique des Sciences Médicales." He was also the author of several works on medicine, and of a series of articles on the health service which attracted the attention of Jules Ferry and other leading statesmen.

THE Governor of Bombay unveiled on November 30 a simple marble memorial tablet in Bombay Cathedral to Lieutenant Bowers, Royal Indian Marine, who lost his life with Captain Scott and his comrades in the Antarctic. We learn from the *Times* that the memorial at Finse, in Norway, in honour of Captain Scott and his companions was unveiled on December 28 by Dr. Skattum, vice-president of the Norwegian Geographical Society. The memorial has taken the form of a monument about 20 ft. high bearing the names of the explorers—Captain R. F. Scott, Dr. Wilson, Captain L. E. G. Oates, Lieutenant H. R. Bowers, and Petty Officer Evans—and an inscription reading:—"Erected by Norwegians in honour of Antarctic research and heroic courage."

A MEETING of the Imperial Advisory Council of the Institute of Industry and Commerce was held on December 22 at the offices of the institute on Aldwych Site, Strand, for the purpose of considering, among other matters, the best means of bringing about the standardisation of company law throughout Great Britain, the Dominions and Colonies in order to facilitate commerce within the Empire. The council decided that a memorandum should be drawn up by the institute after consulting with the leading specialised trade organisations, and that this memorandum be submitted to the Agents General of the Dominions and Colonies for submission to their respective Governments. The policy of the institute is to develop a set of satisfactory working conditions within the Empire in which industry can operate, and if this is accomplished satisfactorily a considerable increase of trade should follow.

A CENTRAL NEWS telegram from Amsterdam, published in the *Times* of December 21, announced that Prof. Otto Sackur was blown to pieces by an explosion which occurred in the laboratory of the Kaiser-Wilhelm Institute at Dahlem, near Berlin, where experiments in high explosives were being conducted. The Kaiser-Wilhelm Institute was founded in 1911 by the Kaiser-Wilhelm Association for the Advancement of Science, and the first volume of results of researches issued by it was described in NATURE of May 28 (vol. xciii., p. 322). Prof. Sackur was one of the ablest of the younger physical chemists in Germany. A pupil of Richard Abegg, he became a Privat-dozent in the University of Breslau, and on Abegg's appointment to the Technische Hochschule there, succeeded him as extraordinary professor in the University. He later received an appointment in the Kaiser-Wilhelm Institute. Sackur was more distinguished as a theorist than as a practical worker. His papers cover a wide range, and are characterised by considerable independence of thought. In 1912 he published a "Lehrbuch der Thermochemie und Thermodynamik," which is an admirable modern introduction to the subject, and is, we understand, being translated into English.

THE Duke of Bedford presided at the general monthly meeting of the Zoological Society on December 23, 1914; twenty-two new fellows were elected, the honorary membership of the society was conferred on Field-Marshal Earl Kitchener of Khartum, and eight new names were added to the list of corresponding members. During November fifty additions were made to the menagerie, of which forty-two were presented; among the latter particular interest attaches to a pair of South African elands presented by Mr. A. H. Wingfield, of Ampthill House. During the same month the number of visitors to the gardens was 26,403, or 15,166 fewer than in November, 1913. From January 1 to November 30 the total number of visitors was 1,037,929, representing a decrease of 90,225, as compared with the corresponding period in 1913.

IN a letter to the *Times* of December 26, and in an article in the *Strand Magazine* for January, 1915, Sir E. Ray Lankester disputes the idea that Germans are entitled to special pre-eminence in the domain of physical sciences. On the contrary, with the exception of the work in spectrum analysis in the middle portion of last century, their claims to original discoveries of importance, more especially during the reign of the present Kaiser, are comparatively insignificant. Their real line of success lies in their capacity for adopting and developing the discoveries made in other countries for their own interest and benefit, more especially when large profits are to be made, as in the case of the artificial synthesis of indigo and other organic products, by such means. In their voluminous treatises on the history of science published during the last forty years they have in many instances deliberately ignored the claims of investigators in other countries to discoveries and ideas upon which their own work is based.

THE Committees on Food and Hygiene of the Paris Academy of Sciences have presented reports dealing with the conservation of cattle during the war and with the alcohol question. In view of the meat supply required for the troops and the necessity of reserving the best animals for reproduction, it is recommended that all young animals and calves should be preserved and that importations of meat from Australia, New Zealand, the Argentine Republic, and the French colonies should be encouraged. It is also suggested that animals should be killed in the place where they were raised, as the transport of live cattle is attended with many disadvantages. The installation of large cold storage depôts is recommended. Recommendations were also made with regard to the consumption of alcohol. It is proposed that the number of places open for the sale of alcoholic drinks should be limited, that absinthe and similar liqueurs should be absolutely prohibited, and that the privilege of the *bouilleurs de cru* should be suppressed. These conclusions were unanimously adopted by the academy, and forwarded to the Government.

A NOTICE recently appeared in *Science* that the late Dr. Albert Günther's collection of pamphlets relating to fishes, amphibia, and reptiles has been secured by the Carnegie Museum at Pittsburgh. As a matter of fact, some years have elapsed since Dr. Günther, finding that through failing eyesight he could no longer make full use of this portion of his scientific library, and being naturally loathe to break up an unrivalled collection of separate papers and monographs gathered from the scientific periodicals of the eighteenth and nineteenth centuries, and knowing of no purchaser in this country, determined to sell the collection as a whole to Prof. C. H. Eigenmann, of Indiana University, who also held the post of curator of ichthyology in the Carnegie Museum. The collection shipped to America in August, 1910, comprised nearly 7000 octavo and 600 quarto and folio pamphlets, by some 1200 authors. The possession of so complete a literature in so compact a form enabled Dr. Günther to identify and describe collections of fish at home without always having to visit public libraries. He often said that so complete a series of the smaller monographs on the ichthyology and herpetology of the time would probably never be accumulated again. May their value be as great in the New world as it has been in the Old!

As announced with regret last week, Mr. A. R. Hunt, who was well known in the British geological world, died at his residence, Southwood, Torquay, on December 19, aged seventy-one years. Son of a chief of an old firm of wine shippers, he was born and lived his earliest years in Portugal. After taking his M.A. degree at Trinity College, Cambridge, he read for the Bar, and was enrolled a barrister of the Inner Temple, not, however, to follow the profession. His family settling in Torquay, brought him into association with Pengelly, and the stirring revelations of

Kent's Cavern, and under these influences he found his interests and attention directed towards natural science. In 1872 he was elected a member of the Torquay Natural History Society, and for the rest of his life he gave that institution his enthusiastic support, serving for long on the committee and as president for the years 1879–81. He was closely associated with the Kent's Cavern explorations, and his familiarity with details and parts rendered him the best fitted man then living to conduct the Geologist's Association through the cavern on its visit to Torquay in 1901. Mr. Hunt's fondness for sailing led to his striking out a line of investigation that put his yacht to scientific use by exploring the inshore sea bottom with dredges and studying the action of shore waves and currents. This he followed up by constructing experimental tanks, and his researches were recognised by practical engineers dealing with the problems. His literary contributions to science are mainly included in the Transactions of the Devonshire Association, which contain thirty papers by him. More communications in number are contained in the *Geological Magazine,* and he also contributed to the Linnean Society's Journal.

M. ROMAIN ROLLAND's eloquent appeal now appears in pamphlet form—"Above the Battlefield" (Cambridge: Bowes and Bowes; price 6*d.* net). Its main thesis should be interesting to scientific readers, since it is an indictment of European leaders of thought for their attitude to war in general and the present war in particular. War, he assumes, is a catastrophic calamity to civilisation and the race; "it is always the octopus sucking the best blood of Europe"; "is there no end to this bloody and puerile sport, in which the partners change about from century to century—no end, until the whole of humanity is exhausted thereby?" Many who might protest are apt to listen to "the old refrain of the herd that makes a god of its feebleness . . . 'the fatality of war is stronger than our wills.'" But "there is no fatality! The only fatality is what we desire; and, more often, too, what we do not desire enough." Leaders of thought, guardians of the pillars of knowledge which support the fabric of culture, "did not desire war. . . . What then did they do to prevent it? What are they doing to put an end to it?" Some are passive, but the majority are active, "stirring up the bonfire, each one bringing his faggot." In this "epidemic of homicidal fury . . . all the forces of the spirit, of reason, of faith, of poetry, and of science, all have placed themselves at the disposal of the armies in every State. There is not one amongst the leaders of thought in each country who does not proclaim with conviction that the cause of his people is the cause of God, the cause of liberty, and of human progress. And I, too, proclaim it."

THE great photographic collections of the National Geographic Society of Washington have again been utilised for a valuable topical issue of the *National Geographic Magazine* for November, which is occupied by a paper under the title of "Young Russia—The Land of Unlimited Possibilities," by Mr. G. H. Grosvenor. The sketch of Russian history, ethnology, geography, and industrial resources is slight, but pleasantly written. The feature of the number is one hundred admirable photographs, of which seventeen are in colour, which represent various phases of city and village types, religion, art, and scenery, with groups of the many races included in the empire.

OF the two chief articles in the December issue of the *American Naturalist,* one, by Prof. J. H. Morgan, relates to the failure to produce mutations in Drosophila by means of ether, while the other, by Prof. J. S. Dexter, is devoted to the analysis of a case of continuous variation in the same genus.

A THIRD contribution to the account of the Long Island fauna and flora, now in course of publication in the Science Bulletin of the Brooklyn Institute, forms the contents of vol. ii., No. 3, of that serial. In this part Dr. F. Overton treats of the frogs and toads, which include ten species, referable to five genera and four families.

THE December number of the *Irish Naturalist* is a very thin one; containing, in addition to notes, reviews, etc., only an article by Mr. E. M. Barrington on the migration of wrens, in which it is shown that numbers of these apparently poor flyers regularly cross the Channel twice a year. The fact being established that the species is a constant migrant leads the author to ask how it comes about that local races have been established in St. Kilda and the Faröes.

Wild Life continues to appear regularly, albeit with a certain reduction in the number of pages, despite the fact that both the editor, Mr. Douglas English, and his collaborator, Mr. W. R. Knight, are serving their King and country, the former as a subaltern in the 1st Surrey Rifles, and the latter as a private in the 1st Batt. H.A.C. In the December issue Mr. Russell Roberts concludes his realistic account of the black rhinoceros; among bird-photographs the most striking is one of a flock of black-headed gulls on the wing, by Mr. H. B. Macpherson.

FOR some time past, as we learn from the report of the council for 1913–14, the Natural History Society of Northumberland, Durham, and Newcastle-on-Tyne has been endeavouring to raise a sum of 25,000*l.*, to form an endowment for the upkeep of the Hancock Museum, which is at present a heavy drain on the general fund. Between 3000*l.* and 4000*l.* (including 1000*l.* from Lord Joicey, the president) had been raised, when the outbreak of the war put a stop to the project, at any rate for the present. The most important addition to the museum during the period under review is a magnificent collection of tropical and subtropical butterflies, made by Dr. Eltringham, with special reference to mimicry. A part of this series has been placed on exhibition, and the rest retained in the original cabinets.

To the first half of the Bergens Museum *Aarbok* for 1914–15 Dr. A. Brinkmann communicates the description of a new genus and species of nemertine annelids, based on a male and female dredged in May, 1914, in the North Sea, at a depth of between 1000 and 1200 metres. The new genus belongs to the family Drepanophoridæ, but is peculiar in the circumstance that the rhynchocœlom and the œsophagus open by a common aperture, this feature being recorded in the name Uniporus. The typical *U. hyalinus* is characterised by the total absence of pigment; but in two other members of the genus, one of which was described in 1901 as *Drepanophorus borealis,* the upper surface is well pigmented. The paper concludes with remarks on the affinities and systematic position of the Drepanophoridæ. In another article Mr. B. Tyvold discusses the structure and relations of the parasitic "zoophytes" of the genus Sphyrion, which are found on the fins of lumpsuckers and gurnards, and, although described by Cuvier, have hitherto remained a puzzle to naturalists. It is now decided that their true position is in the family Chondracanthidæ. Whaling at Durban and Saldanha Bay and the various species of whales taken there, form the subject of a third article, by Mr. O. Olsen, who recently described a new species of finwhale from these waters.

It is not surprising that the presidential address of Mr. A. D. Hall to the Agricultural Section of the British Association in Australia has excited considerable interest in the Colonies. The *Agricultural News* (Barbadoes) of November 21 discusses the problems of bringing into cultivation land hitherto allowed to run to waste, in its bearings on West Indian agriculture and conditions. Two phases of winning new land are in progress simultaneously in the West Indian islands—the clearing of fertile soils as yet untilled and the reclaiming of land hitherto regarded as unprofitable to farm. Efforts are also being made to regenerate areas once under cultivation, which have been robbed of their fertility by defective methods of farming. Since loss of water from the soil surface is one of the most important factors in determining fertility under tropical conditions, any methods of reducing this loss have especial significance. Mr. Hall suggests that evaporation can be checked by the provision of screens or hedges that will break the sweep of the wind across the land. Screens of this kind have long been used in the islands to protect such crops as cacao and limes from the persistent sweep of the trade winds, but their use for the conservation of moisture in the soil has received little consideration, and experiments in this direction might profitably be made.

A "Note on the preparation of Indian forest floras and descriptive lists," issued as Forest Bulletin, No. 23 (Calcutta, 1914), by Mr. R. S. Hole, will be found interesting and useful to botanists generally as well as to those concerned with forestry. The author emphasises the importance of taking a comprehensive view of the entire forest vegetation instead of confining attention to the large timber trees, and points out that numerous minor products, some of them of considerable value, are obtained in India from trees and shrubs as yet unidentified, besides the revenue obtainable from insignificant herbs and grasses which form the forest undergrowth or occur in open places in the forest areas. His paper is intended as a first step towards the preparation of simplified floras and descriptive lists and schedules suitable for officials who cannot be expected to have the leisure or the botanical knowledge necessary for the successful identification of species by the floras now in existence. He draws a sharp distinction between the scope and function of a flora and a descriptive list respectively, and gives a summary of the information which it is proposed to include in the latter, together with an admirably planned schedule which includes the ecological as well as systematic characters.

In a valuable paper on the development of the Trinidad oilfields, contributed to the last meeting of the Institution of Petroleum Technologists, Prof. J. Cadman traced briefly but clearly the history of this little-known oilfield, which properly commences, as the paper shows, with the prospecting operations of Mr. Randolph Rust at Guayaguayare in 1902. The mere fact that within thirteen years this oilfield has produced more than seventy-two million gallons of oil, and that the annual output is already more than twenty-two million gallons, in quite sufficient evidence that this field has attained a position of decided importance amongst the sources of supply of petroleum of the British Empire. As Prof. Cadman points out, it is not yet possible to predict what the life of the wells is likely to be, but so far there seems to be no good reason to fear any abnormally rapid rate of exhaustion of the oilfield. There are numerous interesting problems, both technical and geological, presented by this field, which is remarkable for the high pressures existing in the oil-sands and for the considerable proportion of sand carried up by the crude oil. The author has shown how these difficulties have hindered the more rapid development of the oilfield, and gives an interesting account of the methods used to overcome them.

The *Philippine Journal of Science* for June last (vol. ix., sec. A., No. 3) contains an interesting account of an occurrence of iron ore in the province of Bulacan, Island of Luzon, as also of a somewhat special industry of iron smelting that has been developed therefrom. The ores consist of magnetite and hematite, and these are smelted by the natives in small blast furnaces, the iron produced being cast direct into moulds for the production of ploughshares and ploughpoints. The furnaces are built of soft clay bricks set in clay, and cased with bamboos, and are about 7 ft. 6 in. in height, and 5 ft. in external diameter; the inner cavity is 5 ft. 9 in. deep, and is conical, tapering from 40 in. at the top to 20 in. at the bottom. It is fitted with a single clay tuyere, and is blown with the usual Chinese double-acting hand-blower, made from a hollow tree trunk, and fitted with a wooden piston packed with feathers; the blower is 11 ft. 6 in. long and 14 in. in diameter. The furnace is charged with ore and charcoal at intervals, an average charge consisting of 55 lb. of ore and 95 lb. of charcoal; no flux is used. Such a furnace produces about 5 cwt. of castings daily, the iron being a hard white iron, low in silicon, but containing a fair percentage of carbon. The extraction of iron is only 68 per cent. of that present in the ore, most of the loss being due to prill of iron entangled in the viscous slag. The process is particularly interesting, as detailed records of the production of cast-iron in furnaces of such a primitive type are not numerous. The industry is very evidently Chinese in its origin, and it seems obvious that it owes little or nothing to European influences.

DURING the forced rest from his usual busy, scientific work Dr. H. R. Mill recently spent three and a half months in New Zealand, and visited the meteorological stations between Stewart Island, in the south, and the Bay of Islands, in the north, in which he was assisted in every way by Mr. D. C. Bates (Dominion Meteorologist) and others. He has embodied his impressions and notes obtained of the climate in an interesting article, untrammelled by tables or diagrams, in *Symons's Meteorological Magazine* for December. Among many other matters, he points out that although Great Britain lies nearer the pole than any part of New Zealand, the climates are much alike, summer in the South Island being apparently no warmer than in England; the lower latitude, however, ensures a greater intensity of sunlight, and vegetation proves that the mean temperature of winter is much higher than Great Britain. The prevailing wind being westerly, the mountains receive a rainfall exceeding 100 in. in many places, while on the east much of the area has an average of less than 20 in. The climate of the North Island is decidedly warm in summer, and there is a marked contrast between the two seasons. Great faith is attached to the weather forecasts; weather conditions being simpler the prognostics are less liable to misinterpretation than in Western Europe. Changes and movements of clouds appear to be more expressive of weather changes than in this country, and much use is made of them in filling up the gaps in telegraphic reports.

IN the *Comptes rendus* of the Paris Academy of Sciences for November 30 M. Colardeau describes an X-ray method of localising foreign bodies imbedded in the tissues. The matter is of special importance at the present time on account of the war, and during the past few months many suggestions have been made. The Röntgen Society, under the presidency of Sir Alfred Pearce Gould, has already devoted its December meeting to the question, and a further discussion is arranged for January. M. Colardeau's method differs but slightly from the plan introduced some years ago, and now almost universally adopted with the addition of minor improvements, by Sir James Mackenzie Davidson.

THE Journal of the Washington Academy of Sciences for December 1 contains an abstract of a paper by Mr. L. W. Austin, of the Naval Radio-telegraphic Laboratory, on quantitative experiments in radio-telegraphic transmission. The signals were sent from the station at Arlington, Virginia, which uses the Fessenden rotary gap giving an antenna current of 100 amperes and a wave-length of 3800 metres. The aerial is triangular with a mean height of 400 ft. Short-range experiments showed that owing to insufficient conductivity of the soil the effective height of the antenna was only 200 ft. The strength of the signals was determined by the shunted telephone method on board the U.S.S. *Birmingham* on a voyage to Gibraltar and back. The effective height of the receiving antenna was 114 ft., and the effective resistance 50 ohms. For distances between 300 and 2000 miles the strength, I_R, of the received signals could be expressed by the equation $I_R = (120\pi h_S h_R I_S / \lambda d R) \exp. (-0{\cdot}0015 d/\sqrt{\lambda})$, where h_S and h_R are the effective heights of sending and receiving antennæ, I_S the sending antenna current, λ the wave-length, d the distance of the stations apart, and R the resistance of the receiving system. This is a slight modification of the theoretical expression given by Sommerfeld. The complete paper will be published in the Bulletin of the Bureau of Standards.

MESSRS. BURROUGHS WELLCOME AND CO., Snow Hill Buildings, have sent us a copy of the Wellcome Photographic Exposure Record and Diary for 1915, which is a neat little pocket-book with a strong canvas cover. Having been issued for several years, and each year revised and brought up to date, it is now the most compact essence of photographic information —a veritable "tabloid." If you want to know how to tone bromides green, how much flashlight powder to use, about night photography, about speeds of papers and plates, and about a host of other requirements of the photographer, whether amateur or professional, you have only to look into this pocket-book where the information is dealt with clearly, tersely, and accurately. Practical experience of practical men is embodied in these pages, and the experience culled by experiments and long practice is analysed and set forth in simple formulæ and precise directions, not only helping the beginner, but saving him time, trouble, and material. The Wellcome Exposure Calculator, fitted ingeniously in the inside of the back cover, has only to be used once to be used always. By one turn of the scale the correct exposure for any plate or film is immediately given for any time of day or year. Blank forms are given for the entry of all details about each photograph taken, and these are followed by a diary for entry of ordinary daily memoranda. The book is issued in wallet form, complete with pencil, and three editions are published, suitable for the northern hemisphere, the southern hemisphere, and the United States. It is a cheap shillingsworth, and every photographer should invest in one.

FIVE short papers on audible and other cab signals on British railways were read and discussed at the Institution of Mechanical Engineers on December 18. These papers express the opinions of engineers connected with, and describe experiments which have been in progress on, the Midland, Caledonian, North-Eastern, Great Western, and Metropolitan Railways. It is generally admitted that the present system of semaphores and lamps is not entirely trustworthy, and it is hoped that some standard system of cab signalling which will be effective may be evolved soon. As was pointed out by Mr. Blackall, of the Great Western Railway, it is very important that some standard should be conformed to, so that the engines belonging to one railway passing over to the system of another may be able to pick up the signals which would ordinarily be given to the engines belonging to the latter system.

A new Diesel marine engine, built by Messrs. Doxford and Sons, of Sunderland, is described in the *Engineer* for December 25. In this engine the complicated cylinder cover casting with its valve arrangements is got rid of by having two pistons in the cylinder working in opposite directions. The upper piston is attached by a piston rod to a compensating arm, which is connected by two rods, one on each side of the cylinder, to two cranks placed at 180° to a central crank; the lower piston is connected in the usual manner to the central crank. The various operations in the cycle take place between the two pistons. The exhaust escapes through ports in the top end of the cylinder; these are uncovered by the upper piston when near the top of its travel. Scavenging air is admitted through corresponding ports at the bottom end of the cylinder; these are uncovered by the lower piston, and ensure a capital flow of scavenging air throughout the whole cylinder. The admission valves are placed at the middle zone of the cylinder. Cooling water is supplied to the lower piston through a rocker arm, and to the upper piston through a telescopic tube; the latter arrangement is open to some criticism on account of the difficulty of preventing leakage.

The issue of "Hazell's Annual for 1915" is now ready. This is the thirtieth year in which this useful "record of the movements of the time" has been published. Some idea of the number of topics dealt with may be formed from the fact that the index to the volume contains close upon 20,000 entries. As is natural, great prominence is given to facts in connection with the war, but this engrossing subject is not allowed to overwhelm the other matters of importance dealt with in previous issues. A section entitled "The March of Science," runs to about thirty-four pages, and includes a summary of the proceedings at the British Association meeting in Australia, and a *résumé* of progress in scientific research during 1914. We are glad of the opportunity to extend the praise offered in these columns to the trustworthiness and completeness of previous editions of the annual to the present issue, the price of which is 3*s*. 6*d*.

Mr. C. Baker, 244 High Holborn, London, has issued his January list of second-hand scientific instruments which he has on sale or for hire. Particulars are given of more than 1500 pieces of apparatus, prominent among which are numerous microscopes and telescopes and their accessories. Every instrument is guaranteed to be in adjustment, and arrangements can be made for workers in the country to have pieces of apparatus on approval.

OUR ASTRONOMICAL COLUMN.

A Remarkable Meteor.—On Tuesday, December 15, at 6h. 25m. p.m., an extremely slow-moving meteor was seen by Mr. W. F. Denning at Bristol, and by Mrs. Wilson at Bexley Heath. It had rather a long flight, and was much brighter than a first magnitude star. The meteor was curious as belonging to a radiant point in Aquarius at about 336°–12°, and at the same position as the July Aquarids. No meteors have hitherto been recorded, so far as is known, from this radiant so late in the year. The object of December 15 last had a height of from sixty-seven to forty miles, its luminous course extended more than seventy miles, and its velocity was fourteen miles per second. The meteor must have been observed by many persons, the night being very clear and the object a very conspicuous one with an extensive trajectory. At the middle of December a well-defined shower of slow meteors from between α and β Persei at 48°+44° was prominently active. This same radiant has been observed at many other times of the year, but never before on December 15 and 16.

Parabolic Orbits of Meteor Swarms.—In the Publications of the Leander McCormick Observatory (vol. ii., part 4) a paper on 126 parabolic orbits of meteor swarms is published by Mr. Charles P. Olivier, these deductions being made by him from more than 2800 observations of meteors, the combined work of the American Meteor Society. Mr. Olivier directs particular attention to the excellent work carried on by this society in spite of its youth, and hopes for more ideal methods of work in the future. It may be remembered that the author previously (1911) published a paper entitled "175 Parabolic Orbits and other Results Deduced from over 6200 Meteors," which appeared in the Transactions of the American Philosophical Society, N.S. (vol. xxii., part 1), and the present contribution may be considered practically a continuation of the above, the first radiant here numbered, namely, 177, following serially the radiants given in the 1911 publication.

One of the chief problems of meteoric astronomy is that of stationary radiants, and in many quarters it is considered that many of them exist, while other workers on theoretical grounds look upon them as mathematically impossible except in a few cases. Mr. Olivier attacks the problem by inquiring into the method of the reduction of the radiant points, and concludes that the usual process of combining observations of many successive dates, and radiants which lie sometimes as much as 10° from one another, etc., tend to influence greatly the result. His results, reduced separately for each date, "show almost no evidence of stationary radiation, and so far as they go may be considered to disprove its existence." Numerous interesting tables accompany this paper, among which may be mentioned that containing the 126 parabolic orbits; elements based on eight radiants suggesting these meteors were originally intimately connected with Halley's comet; ten orbits belonging to the main Perseid stream, confirming their connection with comet 1862 III., or Tuttle's comet, and other tables giving the magnitudes of the meteors seen, percentages of meteors of a given magnitude to the totals seen, and their colour and duration.

The Spectrum of 10 Lacertæ.—The star 10 Lacertæ (R.A. 22h. 35m., declination +38° 32′, magnitude 5·0) displays a spectrum which is conspicuous for the sharpness of the important line at wave-length 4686 and of the other lines of hydrogen and helium. This star is therefore not only suitable for a good determination of its radial velocity, but affords an opportunity of obtaining an accurate measure of the stellar wave-length of the line at 4686 and other lines. Both these objects have been investigated by Messrs. E. B. Frost and Francis Lowater, and the results are described in the *Astrophysical Journal* for October (vol. xl., No. 3, 1914, p. 268). The line 4686 is now generally regarded as a line in the principal series of helium, and the laboratory work of Prof. Fowler has consigned to it the wave-length 4685·90. The line is recorded in the spectrum of the chromo-